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A Revision of the Family Fouquieriaceae

BY GEORGE V. NASH

During an attempt to identify one of the species of *Fouquieria* which flowered in the conservatories of the New York Botanical Garden during the past June, much confusion was found to exist, both in the identification of herbarium material and in the literature bearing upon this family. So great was this confusion that the writer was eventually compelled to extend his examinations beyond the point he had anticipated, and finally realized that a revision of the family was necessary before any definite results could be obtained. No recent treatment, involving a consideration of the species, could be found, and the apparent need of such work encouraged the author to enter upon the following revision, which, it is hoped, will throw some light upon an interesting family and one but little understood. As here regarded, it embraces two genera and seven species, three of which are here described for the first time.

The relationship of the family is rather puzzling, and a satisfactory solution of the difficulty has not as yet been proposed. By Bentham and Hooker (Gen. Pl. 1: 161) it was made a tribe of Tamaricaceae, and the same treatment was accorded to it by Engler and Prantl (Nat. Pfl. 3⁶: 298). Subsequently Engler (Nat. Pfl. Nachtr. 251) maintained that the family was better kept separate from Tamaricaceae on account of its oily endosperm and gamopetalous corolla. Its distribution would also tend to confirm this distribution of the group, for Tamaricaceae, with Fouquieriaceae removed, is strictly Old World, while Fouquieriaceae itself is confined to North America, and primarily to its arid regions.

While Engler changed the rank of this family, he indicated no change in its relationship. It is hardly within the scope of a revision of this kind to discuss at length a matter of this nature, but the strong resemblance in many ways to certain forms of the Polemoniaceae cannot be passed by without some comment. In this connection it is well to remember that it was in this family, as a *Cantua*, that the original species was published. The 3-celled

ovary, the more or less united styles and the gamopetalous tubular corolla, to the base of which the filaments are slightly adnate, all markedly point in this direction. The spongy central column found in the dehiscing capsules would indicate that the inner edges of the septa unite. A transverse section of the ovary made at this time, and before the septa break away from the walls, would much resemble the condition of things existing in the genus *Gilia*, also found in the same region. The general resemblance of the flowers to those of some of the large-flowered red *Gilias* is perhaps the most striking feature of the plants. It is true that the sepals in this are distinct, while in *Gilia* they are more or less united, but this is but one character weighing against many others. It would seem to me that the ovarian, placental, style and corolla characters indicate a strong affinity with that family, much stronger than with the Tamaricaceae, to which family, polypetalous in all its other forms as are its immediate relatives, the gamopetalous corolla of Fouquieriaceae does violence.

FOUQUIERIACEAE DC. Prod. 3: 349. 1828.

Shrubs or trees, the trunks simple, columnar and stout, or much branched: branches spine-branching. Spines developed within the petioles of the leaves on the new growth and becoming apparent when these fall. Leaves with the blades flat, entire, or rarely obcordate or emarginate: those on the young growth petioled, the petioles from one half as long as to equalling the blade. Secondary leaves borne in fascicles in the axils of the spines and sessile or nearly so. Inflorescence spicate to paniculate, terminal. Flowers sessile or pedicelled. Calyx of five free imbricated sepals. Corolla yellow or red, hypogynous, the segments united for one half their length or more: tube cylindric, sometimes broadened toward the apex: lobes flat or concave, imbricated in the bud, incurved, erect, spreading, reflexed or enrolled. Stamens ten to fifteen, of unequal length, exserted from the corolla-tube, and adnate to it at the very base: filaments subulate, usually broadened and compressed dorsally at the more or less pubescent base where they are sometimes coherent, sometimes provided with a scale-like appendage near the base: anthers acute at the apex, cordate at the base, elliptic to nearly ovate, introrse, versatile, attached below the middle, 2-celled, the cells opening longitudinally. Ovary 3-celled, the inner edges of the septa united at the base and at the very apex, free in middle, the septa finally

uniting by the inner edges and breaking away from the walls, forming a central column attached at the apex and at the base. Ovules 4-6, in two rows, in each cell, borne on the edge of the free portion of the septa. Styles 3, slender or stout, included in or exserted from the corolla, united only at the base or for their entire length. Capsule dehiscing loculicidally, 3-valved, the valves thick and coriaceous. Seeds oblong, compressed, at first broadly winged, the wing finally breaking up into long filaments similar to those on the body of the seed. Albumen thin, oily. Cotyledons flat, oblong to ovate, cordate at the base. Radicle short.

Genera two, both natives of Mexico, one, *Fouquieria*, also found in the adjacent parts of the United States. The *Idria* of Kellogg is often united with *Fouquieria*, but it seems more natural to keep it separate, both on account of habital characters and differences in the flowers. The short stout included styles united for their entire length, yellow flowers and columnar, normally unbranched trunk, justify this treatment.

Styles more or less united, but free at the apex, exserted, the column and branches slender: shrubs or trees with branching trunk: corolla red. 1. *Fouquieria*.
 Styles wholly united, stout, short, included, forming a 3-angled stout body: tree with a stout columnar undivided trunk: corolla yellow. 2. *Idria*.

1. FOUQUIERIA H.B.K. Nov. Gen. & Sp. 3: 452. 1820

Bronnia H.B.K. Nov. Gen. & Sp. 6: 83. 1823.

Philetaeria Liebm. Vidensk. Selsk. Skr. V. 2: 283. pl. 1851.

Shrubs or trees with spicate or paniculate inflorescence and red sessile or pedicelled flowers. Sepals less than one half as long as the corolla-tube. Corolla red, cylindric to campanulate, the segments united into a tube for one half their length or more, the tube sometimes gradually enlarged toward the apex: lobes from erect to recurved or enrolled. Stamens ten to fifteen, more or less broadened and compressed dorsally at the pubescent base. Styles slender, exserted, united only at the base, or nearly to the apex.

Species six; Mexico and the adjacent parts of the United States.

Inflorescence corymbiform-paniculate.

1. *F. fasciculata*.

Inflorescence conic to elongated paniculate, or spicate.

Corolla-tube cylindric, several times longer than the lobes.

Inflorescence spicate.

2. *F. formosa*.

Inflorescence paniculate.

Filaments unappendaged: panicle conic to ovate: bushy shrubs or trees.

Corolla-tube 3-4 mm. in diameter : sepals oval : panicle-branches slender. 3. *F. Macdougalii*.

Corolla-tube 5 mm. in diameter : sepals orbicular : panicle-branches stout. 4. *F. peninsularis*.

Filaments with a scale-like appendage near the base : panicle long and narrow : shrubs with long slender simple branches.

5. *F. splendens*.

Corolla campanulate, the tube about equalling the lobes. 6. *F. campanulata*.

1. *Fouquieria fasciculata* (R. & S.)

Cantua fasciculata R. & S. Syst. 4 : 369. 1819.

Fouquieria spinosa H.B.K. Nov. Gen. & Sp. 3 : 452. 1820.

Bronnia spinosa H.B.K. Nov. Gen. & Sp. 6 : 84. *pl.* 528. 1823.

Cantua spinosa Willd.; H.B.K. Nov. Gen. & Sp. 6 : 84. 1823.

Echeveria paniculata Mocino & Sessé; DC. Prod. 3 : 350. 1828.

A tree 4 m. tall or more, with white fragile wood and round glabrous spiny branches. Leaves fascicled in the axils of the spines, obovate-oblong, rounded at the apex or sometimes emarginate, cuneate at the base, glabrous, shining, about 2.5 cm. long and 9-10 mm. wide : panicle terminal, corymbose, much-branched, its branches glabrous : capsule about 1 cm. long : sepals nearly orbicular, about one fourth as long as the capsule : seeds oblong, compressed, the margin membranous-winged, the inner surface concave, the outer convex, brown, glabrous, the wings nearly entire, emarginate at the apex and at the base ; episperm thinly membranous, adhering to the endosperm which is thin and fleshy ; embryo included, straight, almost as long as the endosperm, compressed ; cotyledons leafy, ovate, obtuse, cordate at the base, fleshy ; radicle cylindric, somewhat acute, one third as long as the cotyledons.

The above description is drawn from the original in the work of Humboldt, Bonpland and Kunth, cited above. I have seen no specimens of this species, but its corymbiform panicle is unlike that of any of the others. The type material was in fruit only, and was secured at Puente de la Madre de Dios, at an altitude of about 5,280 feet. This place is somewhere in the neighborhood of Mexico City or Actopan, but it has not been possible for me, up to the present time, to locate it more definitely.

It is interesting to note here that this is the type of *Fouquieria*, a monotypic genus at that time, which was based on *Cantua fascic-*

ulata R. & S. (although H.B.K., for no apparent reason, credit it to Willdenow). Subsequently *Fouquieria* was again published, this time being based on an entirely different plant, *F. formosa*, and at the same time *F. spinosa*, alluded to above, was made the type of the new genus *Bronnia*. The genera are, therefore, synonymous, *Fouquieria* taking precedence on account of the priority of publication.

2. FOUQUIERIA FORMOSA H.B.K. Nov. Gen. & Sp. 6: 83. *pl.* 527. 1823.

Echeveria spicata Mocino & Sessé; DC. Prod. 3: 349. 1828.

Philetaeria horrida Liebm. Vidensk. Selsk. Skr. V. 2: 283. *pl.* 1851.

A branching shrub 2–3 m. tall, with a racemose inflorescence and large red flowers. Leaves on the new growth 3–4 cm. long, petioled; petiole about one half as long as the blade; blade 2–2.5 cm. long, 10–13 mm. wide, elliptic, apiculate, cuneate at the base: fascicled leaves in the axils of the spines smaller, sessile or nearly so, elliptic, 1.5–3 cm. long, usually less than 1 cm. wide, rounded at the apex, cuneate at the base: spike 1.5 dm. long or less, the flowers ascending: sepals red, 8–11 mm. long, broadly oval to orbicular: corolla red, the tube a little curved, cylindric, about 2 cm. long and about 7 mm. in diameter, the lobes spreading or reflexed, orbicular, abruptly acuminate, 6–8 mm. long: stamens exserted, unequal in length, sometimes twice as long as the corolla, the filaments a little broadened and compressed below, glabrous at the base, then pubescent for a short distance with long ascending hairs, the remainder of the filament glabrous, the anthers oblong-ovate, cordate at the base, acute at the apex, 5–6 mm. long: styles united except at the apex, shorter than the longest stamens, the divisions 3–5 mm. long.

Southern Mexico.

Specimens examined. — Jalisco: Guadalajara, *Pringle* 2420, 1889. Puebla: Tehuacan, *Pringle* 6296, 1895. Mexico: Chiquihuite, *Bourgeau* 1120, 1865–6.

This is quite distinct from any of the other species in its spicate inflorescence. The exact locality from which it was originally secured is not indicated. The specimens cited above would point to the southern part of Mexico as its home. *Philetaeria horrida* Liebm. was obtained in valleys at an altitude of 1500–1800 meters,

in the district of Tehuacan, State of Puebla, from which place Pringle also secured the same plant many years later. Liebmann's excellent plate and description leave no doubt as to the identity of his plant with the one of H.B.K.

3. **Fouquieria Macdougalii** sp. nov.

A much-branched tree, reaching a height of 7 m. and a trunk diameter of 1–2 dm., with bark yellowish green on the trunk and brown on the spiny branches, the spines 1–2 cm. long, and terminal slender panicles of few bright red flowers. Leaves on the new growth 6–8 cm. long, petioled; blade 3.5–4 cm. long and about 1 cm. wide, acute at the apex, and rather abruptly narrowed into a petiole of the same length: fascicled leaves in the axils of the spines gradually narrowed into a sessile base, 3.5–4 cm. long and about 1 cm. wide: panicle slender, 7–10 cm. long, its delicate simple branches widely spreading, the lower ones 3–4 cm. long and bearing 2–4 flowers on slender pedicels which are 1–2 cm. in length and abruptly thickened at the apex: flowers few: sepals broadly oval, about 6 mm. long, the outer two acute, the inner three rounded and apiculate at the apex: corolla about 2.5 cm. long, the tube cylindric, 3–4 mm. in diameter, the lobes broadly ovate, erect, acute, about 5 mm. long: stamens 10, exserted, the filaments red above, white below, broader and dorsally compressed near the base, the interior surface of this compressed portion glabrous, the exterior surface pubescent with long stout hairs which gradually increase in length upward and extend but a short distance on the rounded part of the filament which is glabrous to the summit, the anthers 2–3 mm. long: styles exceeding the stamens, united almost to apex: capsule about 2 cm. long.

Type specimen from living plants, collected at Torres, Mexico, in 1902, by MacDougal, no. 28, which flowered in the conservatories of the New York Botanical Garden in June, 1903.

Sonora and Sinaloa.

Specimens examined. — Sonora: Rayon, *Thurber* 952, 1851; Torres, *MacDougal* 28, 1902; Alamos, *Palmer* 306, 1890; Granados, *Hartman* 226, 1890. Sinaloa: Culiacan, *Palmer* 1804, 1891.

This plant was first secured by Thurber at Rayon, about eighty miles north of the place where it was recently obtained by Dr. MacDougal. Thurber's plant was distributed as *F. spinosa*, from which it differs materially. It is evidently, however, the

plant referred to under that name in the preface to Gray's *Plantae Novae Thurberianae* (Mem. Am. Acad. Arts & Sci. II. 5: 303). His description of this tree agrees with a photograph of one made by Dr. MacDougal. The trunk arises from the ground for two or three feet, and then divides into crooked branches, the ultimate divisions of which are pendulous.

4. ***Fouquieria peninsularis* sp. nov.**

Bronnia spinosa Benth. Voy. Sulph. 16. 1844. Not H.B.K. 1823.

A shrub 2–3 m. tall, with a conic panicle and red flowers. Leaves on the new growth 5–6 cm. long, petioled: petiole about 3 cm. long, about as long as the blade: panicle conic, 1.5 dm. long or less, its branches ascending, stout, the lower ones sometimes 4–6 cm. long and usually divided, bearing 2–4 flowers on the ultimate divisions in a rather crowded manner, on short stout pedicels usually less than 5 mm. long: sepals orbicular or nearly so, 5–6 mm. long, apiculate, reddish: corolla red, the tube slightly if at all curved, about 1.5 cm. long and 5 mm. in diameter, the lobes erect or nearly so, orbicular, acute, 5–6 mm. long: stamens exserted, unequal in length, the filaments broadened and compressed at the base, the inner surface of the compressed portion glabrous, the outer surface pubescent with long ascending hairs, the remainder of the filament glabrous, the anthers 3–4 mm. long: styles united except at the apex: capsule fully 2 cm. long.

Lower California and western Sonora.

Specimens examined.— Lower California: La Paz, *Maj. W. Rich*, Dec. 11, 1847 (type); Turtle Bay, *Anthony* 144, July–Oct., 1896; San Bartolome Bay, *Chas. F. Pond*, March, 1889; Calmalli, *Purpus* 141a, Jan.–March, 1898; Cape San Lucas, *Xantus* 38. Sonora: Guaymas, *Palmer* 266, 1890.

Related to *F. splendens*, but distinguished by the absence of the appendage at the base of the filaments, the more open panicle and the larger capsule.

I have ventured to identify the *Bronnia spinosa* of the Voyage of the Sulphur with this plant, as I have seen material from Cape San Lucas, the place from which that plant was secured. The type of this species was secured at La Paz, only about ninety miles north of Cape San Lucas. Bentham describes the filaments as glabrous, a condition unknown in the genus so far as I have ex-

aminated it. Otherwise his description agrees well with this plant, and as the filaments are pubescent only toward the base the pubescence might readily be overlooked.

5. *FOUQUIERIA SPLENDENS* Engelm. in Wisl. Mem. Tour Mex. 98. 1848.

Fouquieria spinosa Torr. in Emory, Mil. Recon. 147, *pl.* 8. 1848. Not H.B.K. 1820.

A branching shrub, the long slender branches arising from near the base, sometimes to a height of 4–6 m., with a narrow paniculate inflorescence and red flowers. Leaves of the new growth 3–5 cm. long, petioled; petiole about one half as long as the blade; blade 2–3 cm. long, 5–7 mm. wide, narrowly elliptic to oblanceolate, acute at the apex, narrowed at the base: fascicled leaves 1–1.5 cm. long, 5–8 mm. wide, narrowly obovate to obcordate: panicles narrow, solitary or several at the apex of the stem, 5–20 cm. long, the branches usually short and with the few flowers crowded: sepals broadly oval to nearly orbicular, 5–8 mm. long, obtuse or rounded at the apex: corolla red, the tube straight, 15–18 mm. long, gradually a little enlarged toward the apex, 4–5 mm. in diameter at the middle, the lobes spreading and recurved or enrolled, broadly oval to orbicular, obtuse at the apex or sometimes apiculate, 4–5 mm. long: stamens exserted, unequal in length, the filaments broadened and dorsally compressed at the base, the compressed portion running out laterally into a scale-like appendage which is pubescent on the upper surface and 0.5–1 mm. long, the inner surface of this broadened portion glabrous, the outer surface pubescent with long stout hairs, the remainder of the filament glabrous; anthers about 4 mm. long, oblong, abruptly acute, cordate at the base: styles more or less united, only toward the base, or nearly to the apex: capsule 1–1.8 cm. long.

Western Texas and northern Mexico to southern California and northern Lower California.

Specimens examined.—Texas: El Paso, *G. R. Vasey*, May, 1881, and *L. H. Dewey*, June 15, 1891; *Wright 228*, October, 1849. Mexico: Chihuahua and Sonora, *Thurber 401*, May, 1851; Coahuila, *Palmer 80*, 1880; San Pablo, *Gregg*, April 30, 1847. New Mexico: Grant Co., *Mearns 46*, 1892; Little Mt., near Las Cruces, *Wootton*, May and July, 1893. Arizona: Tucson, *Toumey*, April 20, 1894; Tucson Mts., *Toumey 465*, 1892; Willow Springs, *Jones*, May 29, 1890; Gila Valley, *Rothrock 319*; foothills, *Prin-*

gle, April 6, 1891; San Francisco Mts., *Wheeler*, 1872; Squaw Peak, *Mearns* 173, May 6, 1887; Ft. Huachuca, *Wilcox*, June 1, 1892, and 106, 1894. California: *Emory*, November 29, 1846; *Frémont*, 1849; The Needles, *Jones* 3831, May 6, 1884; southern California, *Parish*. Lower California: Rosario, *Orcutt* 1354, May 1, 1886.

This species has a much more extended range than any of the others and is the only one found within the confines of the United States. It may be distinguished at once from narrow-panicled forms of *F. peninsularis* by the prominent appendage near the base of the filaments and by the larger capsule. It has a number of common names, among them being Ocotillo, Coach-whip, Vine-cactus, and Jacob's Staff.

6. *Fouquieria campanulata* sp. nov.

A woody plant with narrow panicle and red campanulate flowers. Leaves on the new growth 3–4 cm. long, petioled; petiole less than one half as long as the blade, which is 2–3 cm. long and 4–5 mm. wide, narrowly oblong or oblanceolate: fascicled leaves 2–3 cm. long, 3–6 mm. wide, oblanceolate, acutish, narrowed to the sessile base: inflorescence a narrow panicle 1.5 dm. long or less, the branches short and spreading and the flowers on them crowded: sepals broadly oval to orbicular, 5–6 cm. long, pale: corolla, from the tip of the recurved spreading lobes to the base of the tube, 12–14 mm. long, campanulate, the tube, which is about as long as the lobes, 3 mm. broad at the base, enlarging to the summit where it is 5–6 mm. in diameter: stamens exserted, unequal in length, the filaments broadened and compressed at the base, the broadened portion running out into a spreading or reflexed scale-like appendage which is pubescent on the upper surface and about 0.75 mm. long, the inner surface of the compressed portion glabrous, the outer surface pubescent with long hairs toward the summit, the remainder of the filament glabrous, anthers ovate-elliptic, cordate at the base, acute at the apex.

Durango.

Specimens examined.—Santiago Papasquiario, *Palmer* 87, 1896.

An exception in the genus in having campanulate flowers. This and *F. splendens* are the only species which have well-developed appendages toward the base of the filaments.

2. IDRIA Kellogg, *Hesperian*, 4: 101, *pl.* 1860

Trees with a stout columnar trunk from which arise short spreading spiny branches. Inflorescence paniculate, arising from

the apex of the trunk, the flowers rather crowded and almost sessile upon the ultimate divisions of the panicle. Corolla yellow, campanulate, the lobes orbicular, concave, incurved, shorter than the tube. Stamens 10, adnate at the very base to the corolla-tube: filaments pubescent below. Styles short, thick, united their entire length, but little longer than the ovary, forming a stout 3-angled body, the angles rounded.

Species one; Lower California.

1. *IDRIA COLUMNARIS* Kellogg, *Hesperian*, 4: 101. *pl.* 1860.

Fouquieria columnaris Kellogg; Curran, *Bull. Cal. Acad. Sci.*

1: 133. *pl.* 1885.

Fouquieria gigantea Orcutt, *West Am. Sci.* 2: 48. 1886.

A tall tree with a tapering trunk up to 3-4 m. in height or even taller, and a diameter at the base of about 3 dm. or more, from which arise the short spreading spiny and leafy branches. Leaves of the new growth unknown: fascicled leaves 1.5-2 cm. long and 5-8 mm. wide, oblanceolate to narrowly obovate: panicles 3-4 dm. long, flowers rather crowded and nearly sessile upon the ultimate divisions: flowers, including the exserted stamens, 12-14 mm. long: sepals orbicular, about 4 mm. long: corolla yellow, 6-7 mm. long: stamens exserted, the filaments pubescent below, the anthers about 3 mm. long: styles about 2 mm. long, thick.

Lower California.

Specimens examined. — Rosalia Bay, *Anthony 120*, July to October, 1896.

Originally collected by Dr. Veatch near the Bay of Sebastian Viscaino, on the mainland east of Cedros Island. The tree was described by Dr. Kellogg as spineless, but this must have been an error, as others who have visited the same region remark upon the long spines which are found on the short branches arising from the trunk. Moreover, a specimen in the herbarium of the New York Botanical Garden, collected by Anthony at Rosalia Bay, but a few miles north of the original station, shows these spine-bearing branches, the spines being similar to those occurring in the other members of this family. Dr. Kellogg describes the trunk as undivided, while Orcutt, in the description of his *Fouquieria gigantea*, states that the trunk branches above the middle, sending up a few simple branches to nearly the height of the main stem. Brandegee, in his account of a collection of plants

made in Lower California in 1889 (Proc. Cal. Acad. Sci. II. 2: 132, 133), also refers to this branched condition, but considers this state as exceptional and due to accident or injury. Both Brandegee and Orcutt claim the trunk attains a height of fifty feet or more. Brandegee remarks that the old capsules are 8-10 mm. long and sessile in the panicle, and that the trunks are 6-9 dm. in diameter at the base, gradually tapering upward into a pointed apex, so that the general shape is much like that of an inverted carrot.

NEW YORK BOTANICAL GARDEN.